If for x in the given series we substitute $\pi + \epsilon$ we have, omitting the factor 2,

$$-y = \sin\epsilon + \tfrac{1}{2}\sin 2\epsilon + \tfrac{1}{3}\sin 3\epsilon + \quad + \frac{1}{n}\sin n\epsilon + \ldots$$

This series increases with n until $n\epsilon = \pi$. Suppose, therefore, $\epsilon = k\frac{\pi}{n}$, where k is a small fraction. The series will now be nearly equal to $n\epsilon = k\pi$, a finite quantity even if $n = \infty$.

Hence the value of y in the immediate vicinity of $x = \pi$ is not an isolated point $y = 0$, but a straight line $-y = nx$.

The same result is obtained by differentiation, which gives

$$\frac{dy}{dx} = \cos x - \cos 2x + \cos 3x - \ldots$$

putting $x = \pi + \epsilon$ this becomes

$$-\frac{dy}{dx} = \cos\epsilon + \cos 2\epsilon + \cos 3\epsilon + \ldots + \cos n\epsilon +$$

which is nearly equal to n for values of $n\epsilon$ less than $k\pi$.

It is difficult to see the meaning of the tangent if y were an isolated point.

ALBERT A. MICHELSON.

The University of Chicago Ryerson Physical Laboratory,
September 6.

Helium in the Atmosphere.

C. FRIEDLÄNDER and H. Kayser have independently claimed to have found helium in the atmosphere. On examination of some photographs of the spectrum of neon I have identified six of the principal lines of helium, which thus establishes beyond question the presence of this gas in the air. The amount present in the neon it is, of course, impossible to estimate, but the green line (wave-length 5016) is the brightest, as would be expected from the low pressure of the helium in the neon.

E. C. C. BALY.

University College, London, Gower Street, W.C.,
September 28.

THE discovery of helium lines in the spectrum of neon, by Mr. E. C. C. Baly, will necessitate a modification of the views we have expressed in our communication to the British Association at Bristol. We there estimated the density of neon at 9·6, allowing for the presence of a certain proportion of argon unavoidably left in the neon. As it contains helium, however, this is probably an under-estimate. It is unfortunately not possible to form any estimate of the amount of helium mixed with the neon from the relative intensity of spectrum lines, as has been already shown by Dr. Collie and one of us; we do not despair, however, of removing a large part, if not all of this helium, by taking advantage of the greater solubility of neon than helium in liquid oxygen.

The presence of helium, however, in no way alters our view as to the position of neon in the periodic table. The number 9·6 implies an atomic weight of 19·2; and a somewhat higher atomic weight would even better suit a position between fluorine, 19, and sodium, 23.

WILLIAM RAMSAY.
MORRIS W. TRAVERS.

University College, London,
Gower-street, W.C., September 28.

Chance or Vitalism?

I AM glad to see that Prof. Karl Pearson has called attention to Prof. Japp's address at Bristol. Only that one does not like to criticise adversely a presidential address, I would at the time have pointed out the weakness in the argument that Prof. Pearson criticises. He does not go nearly so far in this criticism as the circumstances warrant. It is conceded that right- and left-handed crystals of quite sensible size are produced sufficiently separated to be seen and handled as separate crystals. Now assuming, what there is every reason otherwise to think quite probable, that life started from some few centres, the chances are, not that it was equally divided between right- and left-handed forms, but that one or other of these forms preponderated. In fact, if life started from a single centre, it *must* have been either right- or left-handed. Hence the fact adduced only shows, what was otherwise very probable, that life started from a small number of origins, possibly only one.

Another reason for either a right- or left-handed structure in living organisms on the earth, and one which diminishes the force of the foregoing argument for a small number of origins, is that it probably started either in the northern or in the southern hemisphere, and in either case the rotation of the sun in the heavens may be a sufficient cause for a right- or left-handed structure in an organism growing under its influence.

GEO. FRAS. FITZGERALD.

Trinity College, Dublin, September 27.

IN his presidential address to Section B of the British Association, Prof. Japp argues the necessity of supposing a "directive force," or intelligence, to have guided the formation of the first asymmetric substance. "Vitalism," which at one time was supposed to regulate the physiology and even the mechanics of organised beings, has passed more and more from the foreground, till, in the vision of some it remains only as a point in the vast distance of time at the origin of life. Is it to disappear altogether?

A sensible quantity of a mixture of enantiomorphs contains an enormous number of molecules. Chance determines the relative proportion present of right- and left-handed forms. Each molecule, having resulted from the action of symmetric forces, has an even chance of being of one or the other. Hence, the improbability of there being present a great preponderance of one form over the other is so great, that it is inconceivable that an optically active solution could result. To the above contention of Prof. Japp, the reply is made by Prof. Karl Pearson, in NATURE of September 22, that a chance result, however improbable, will occur, if sufficient opportunity be allowed. He postulates the vast ages of the earth's history. May we not, however, invoke chance to deal with masses instead of molecules, and thus perhaps substitute weeks for ages?

Let us consider a solution, in which the numbers of right- and left-handed molecules are very approximately equal, and which is consequently optically inactive. In the slow evaporation of the solvent, the right- and left-handed nuclei, about which the substance crystallises, will *most probably* be evenly distributed. Their number will be extremely small in comparison with that of the molecules, and, as chance determines their distribution, it is not so highly improbable—it is at least conceivable—that the crystals will be unevenly grouped. Suppose such to take place and a partial re-solution, roughly in the lines of the distribution of the two varieties of crystals—a not very improbable event—and we have an optically active solution. Chance has here acted the part played by organised matter in the person of M. Pasteur, by selecting and rejecting the oppositely formed crystals.

Is it yet possible to deny that the first ancestor of lævo-rotatory protein could have been built up from an asymmetric substance, separated in some such way as the above, by the play of chance upon the natural working of symmetric forces?

CLEMENT O. BARTRUM.

17 Denning Road, Hampstead, N.W., September 24.

The Moon's Course.

MAY I refer Sir S. Wilks to the simple and beautifully written autobiography of James Ferguson, F.R.S., self-taught mechanician and astronomer? I will quote a passage.

"Soon afterwards" (the previous date was 1743) "it appeared to me, that although the moon goes round the earth, and that the sun is far on the outside of the moon's orbit—yet the moon's motion must be in a line—that is, always concave toward the sun: and upon making a delineation representing her absolute path in the heavens—I found it to be really so. I then made a simple machine for delineating both her path, and the earth's, on a long paper laid on the floor. I carried the machine and the delineation to the late Martin Folkes, Esquire, President of the Royal Society, on a Thursday afternoon. He expressed great satisfaction at seeing it, as it was a new discovery, and took me that evening to the Royal Society, where I showed the delineation and the method of doing it. When the business of the Society was over, one of the members desired me to dine with him the next Saturday at Hackney, telling me that his name was Ellicott, and that he was a watchmaker. I accordingly went and was kindly received by Mr. Ellicott, who then showed me the very same kind of delineation and part of the

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machine by which he had done it, telling me that he had thought of it twenty years before. I could easily see by the colour of the ink and paper that it must have been done many years. He then told me, what was very certain, that he had neither stolen the thought from me, nor had I from him ; and from that time till his death, Mr. Ellicott was one of my best friends."

The editor of my copy of Ferguson's works, "David Brewster, A.M., 1803," adds that James Ferguson was elected a Fellow of the Royal Society without paying the usual admission fees. This honour he shared with Sir Isaac Newton and Mr. Thomas Simson, the self-taught mathematician. Two Scottish philosophers—David Hume and James Ferguson—died in 1776, both leaving autobiographies of singular beauty and pathos. Our own Huxley, who like James Ferguson was afflicted with "an ineradicable tendency to try to make things clear," has done the same in recent times. Two questions instantly present themselves : (1) On how many distinguished men has this honour been conferred by the Royal Society since these times? and (2), Is there a "watchmaker" now in that learned body? J. HUGHES HEMMING.

Kimbolton, September 24.

A Case of Inherited Instinct.

I THINK the interesting cases mentioned by Captain Hutton on p. 411 will hardly bear the interpretation he puts upon them. In New Mexico three genera of *Stenopelmatinæ* are common, viz., *Stenopelmatus*, *Centhophilus* and *Udeopsylla.* These locusts are nocturnal, and live under logs or in holes in the ground during the day. It is natural, therefore, that they should be attracted by any dark place, such as a cave. The species of *Centhophilus*, like the crickets, are found in houses, which are well adapted to their tastes. There is no new instinct, or revival of a dormant one, exhibited in this choice. Similarly, in Colorado I have found the species of *Centhophilus* to live in mines, which are practically caves of recent origin.

The cave-seeking instinct, therefore, has been practically continuous, and if in New Zealand one genus (*Pachyrhamma*) lives in caves, while its ally (*Gymnoplectron*) is arboreal, it is probable that the former retains the instincts of their common ancestor, while the latter has lost them, so far as the arboreal habit is concerned. T. D. A. COCKERELL.

Mesilla Park, New Mexico, U.S.A., September 15.

Maggots in Sheep's Horns.

IN a letter which appeared in your issue of September 29, Captain Traherne writes under the heading of "Horn-feeding Larvæ," of maggots of about half an inch in length and of a white colour, having been found in the horns of a newly killed sheep, which he had obtained in India, but where there were no perceptible signs of perforation. These were not the larvæ of a Lepidopterous insect, but of one of the Diptera, known as *Œstrus ovis*, a well-known parasite. The fly lays her eggs in the region of the anterior nares, and the larvæ penetrate the nasal passage, finding their way into the turbinal bones, and from thence into the frontal cavity to the base of the horns. Captain Traherne does not say how far up the horn he found them ; they are not usually found beyond the base, but as a rule locate themselves at the back of the throat, where they feed on the mucous substance. They are not horn-feeders. *Œstrus ovis* is distributed pretty generally wherever sheep are to be found.

Mr. Austen, of the British Museum (Nat. Hist.), showed me some very fine specimens, both of the fly and the larvæ.

W. H. MCCORQUODALE.

"Luminous Clouds," or Aurora?

SURELY the "luminous clouds" reported from Cornwall on September 10, in your issue of September 29, were auroral. It is a pity if no other record of altitude has been made, when one observation of such precision is available. I myself have a fairly good record of the upper edge of the bright arch, low down in the N.W. on the previous evening at 11 p.m., as seen from Croydon. If others have a record of this, a comparison might be of value.

It may be worth noting the very probable recurrence of auroræ on the evenings beginning with the 6th inst., when the solar revolution produces the conditions of the last magnetic outbreak, so far as the aspect of the sun is concerned. I have been much struck by this recurrence in working up a series of unpublished auroral observations from York, dating back to 1832.

112 Wool Exchange, E.C., J. EDMUND CLARK.

September 30.

A Hairless Rat.

I SHOULD like to draw the attention of your readers to a peculiar case which may be worth notice.

About ten days ago a man employed at the Ordnance Store Department, Stonehouse, brought me what he termed a "real curio." It was a rat, adult though not very old, without any hair on its body. It was caught in an ordinary trap at the Victualling Yard, and it is still alive, active and, to all appearance, healthy.

In appearance the rat is of a brownish colour, and with the exception of its whiskers, which are normal, and an occasional long woolly hair on the body, it is quite hairless. When at rest the skin is thrown into numerous small folds or corrugations, and its colour is heightened by the dirt which collects in these folds. In active movement the folds disappear. The tail, except an inch at the base, is normal in appearance, though devoid of hair. The ears appear rather larger than usual, and the eyes are somewhat prominent.

On communicating with the Superintendent of the Zoological Society's Gardens, I was referred to a paper by J. S. Gaskoin, in the *Proceedings* of the Zoological Society for 1856. A precisely similar case is there described, concerning four mice captured at Taplow in 1854. One of these gave birth to five young, shortly after capture, and these resembled the parent in every respect. There is no plate in the copy of the *Proceedings* that I have referred to, and the only difference in the description of the mice which does not fit my specimen is the colour of the ears, which are light coloured. T. V. HODGSON.

Municipal Museum, Plymouth, September 29.

THE DYNAMICAL THEORY OF REFRACTION, DISPERSION AND ANOMALOUS DISPERSION.[1]

THE dynamical theory of dispersion, as originally given by Sellmeier,[2] consisted in finding the velocity of light as affected by vibratory molecules embedded in ether, such as those which had been suggested by Stokes[3] to account for the dark lines of the solar spectrum. Sellmeier's mathematical work was founded on the simplest ideal of a molecular vibrator, which may be taken as a single material particle connected by a massless spring or springs with a rigid lining of a small vesicle in ether. He investigated the propagation of distortional waves, and found the following expression (which I give with slightly altered notation) for the square of the refractive index of light passing through ether studded with a very large number of vibratory molecules in every volume equal to the cube of the wave-length :—

$$\mu^2 = 1 + m\frac{\tau^2}{\tau^2 - \kappa^2} + m_{,}\frac{\tau^2}{\tau^2 - \kappa_{,}{}^2} + m_{,,}\frac{\tau^2}{\tau^2 - \kappa_{,,}{}^2} + \&c.$$

where τ denotes the period of the light ; κ, $\kappa_{,}$, $\kappa_{,,}$, &c., the vibratory periods of the embedded molecules on the supposition of their sheaths held fixed ; and m, $m_{,}$, $m_{,,}$, &c., their masses. He showed that this formula agreed with all that was known in 1872 regarding ordinary dispersion, and that it contained what we cannot doubt is substantially the true dynamical explanation of anomalous dispersions, which had been discovered by Fox-Talbot[4] for the extraordinary ray in crystals of a chromium salt, by Leroux[5] for iodine vapour, and by Christiansen[6] for liquid solution

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[1] Abstract of part of the substance of a communication by Lord Kelvin, G.C.V.O., to Section A of British Association at Bristol, on September 9.

[2] Sellmeier, *Pogg. Ann.*, vol. 145, 1872, pp. 399, 520; vol. 147, 1872, pp. 386, 525.

[3] See Kirchhoff-Stokes-Thomson, *Phil. Mag.*, March and July 1860.

[4] Fox-Talbot, *Proc. Roy. Soc. Edin.*, 1870–71.

[5] Leroux, *Comptes rendus*, 55, 1862, pp. 126–128.

[6] Christiansen, *Ann. Phys. Chem.*, 141, 1870, pp. 479, 480 ; *Phil. Mag.*, 41, 1871, p. 244 ; *Annales de Chimie*, 25, 1872, pp. 213, 214.

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